Using the LM3 method to evaluate economic impacts of an on-line retailer of local food in an English market town

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Abstract:

The paper presents a case study of an on-line retailer of locally-sourced food and drink to explore its local economic impacts on an English East Midland market town. The analysis is based on the LM3 survey method which tracks the value of an investment for a local economic area. While the findings suggest a positive impact, the reliability of third round data is disputed, and generates approximations rather than precise indicators of added economic value. In acknowledgement of this limitation, two approaches to working with round three data are compared. The paper concludes with recommendations for using this method in future research, as well as suggestions that might inform the development of a local or regional sustainable and resilient economic development policy framework.

Keywords: local food; local economic impacts; LM3 survey method; on-line retail; economic policy.

1. Introduction

The food and drink sector appears to embody the aspirations of a ‘shop local’ philosophy. Not only is there already something aesthetically attractive about the prospect of eating fresh food that has travelled along a short supply chain from farm to fork (Edwards-Jones et al. 2008), there is also some evidence that doing so may even have potential health benefits (Kellou & Supagro 2014). But there is also a sense that supporting local and independent retailers is good for the local economic area with potential repercussions for the development of local ‘ecological entrepreneurship’ (Marsden and Smith 2005). While the health and environmental benefits of a localised food agenda continue to be debated (Tovey 2009; O’Hara & Pirog 2013), the potential economic impact of supporting local and independent retailers and suppliers may be less contested (SERIO 2012; O’Hara & Pirog 2013).

As Tregear (2011) observes, the benefits of shortened and localised food supply chains are often considered from the perspective of upstream actors, even though many of the benefits said to accrue to localised food supplies are attributed to consumers who are themselves rarely considered in supply chain evaluations. Despite this gap, the added value to wider economic, social and environmental benefits arising from targeted initial investments is a well-recognised strategy in the UK policy context. It underpins ‘shop local’ campaigns in favour of supporting local and independent retailers, and informs the localisation agenda itself (H.M. Government 2011). The recognition of local multiplier effects contributes to the government’s emphasis on accounting for social costs and benefits of projects using public resources which is at the heart of the Treasury’s “Green Book” (HM Treasury 2003).

More recently, the emphasis on localisation has been enshrined in the Public Services (Social Value) Act (Cabinet Office 2012), wherein public authorities are expected to have “regard to economic, social and environmental well-being in connection with public services contracts”. This latter emphasis signals a shift towards evaluations being expected to provide measures of outcomes rather than simply costs and benefits. The difference between the two evaluations reflects a

focus on the efficiency of an intervention or a project, relating to products and outputs, versus a project's effectiveness, which relates to longer-term outcomes. An evaluation of any multiplier effect of local investments in an economic area falls into the latter category of outcome measures, although to date, the local economic literature does not reflect a systematic uptake in the use of the LM3 method for such purposes.

Arguably, the impact of local food supply chains on more rural economies remains a matter for continued research. One aspect of doing so concerns how the structure and patterning of a rural economy can be construed to incorporate other metrics of value in addition to the traditional focus on fiduciary exchange (Midmore & Whittaker 2000). For example, social network analytic methods offer a useful adjunct to more traditional economic analyses by generating insight into the quality of the network of relations among producers, processors, retailers, and consumers within which economic exchanges occur (e.g., Murdoch, 2000). Such network analyses may contribute to evaluating the relative resilience of local economic networks to withstand shocks and shifts in actor dynamics and the wider socio-economic systems within which local economies are nested (Janssen et al. 2006).

In an effort to address some of these issues, this paper draws on original research on the case study of an on-line retailer of locally sourced food and drink, based in the English East Midland town of Market Harborough. Using empirical financial data collected over a three year period, the study evaluates the impacts of an on-line retailer within the local economic area. These data have been calculated to evaluate the impact multiplier effects to the third tier in the upstream supply chain, using the LM3 method (Sacks, 2002).

The local multiplier (LM) method is derived from the macroeconomic theories of Keynes (Cohn, 2015) and Leontief (1986), albeit in a simplified form to promote wider uptake among small and medium sized enterprises. It is envisaged as a tool with which the impact of a given service, project or enterprise on a local economic area may be evaluated in terms of the effectiveness of a primary investment within

that area and has been used to evaluate the localised benefits of tourism as well as other businesses (e.g., Teigeiro & Díaz 2014; Thatcher & Sharp 2008).

In practice, the local multiplier to the third round (LM3) method tracks the movement of spending within a defined economic area[1]. It returns an indicator representing the ratio of an initial financial investment[2] to the total work[3] that investment contributes across, in this case, three successive rounds of spending. In macro-economics, the theory of a multiplier holds that the longer an initial financial investment, or spend,[4] circulates through the economy of a geographically bound area, the greater the work it is thought to have achieved. The multiplier effect refers to the principle that the initial investment is said to be amplified as a result of the increased spending capacity it affords, resulting from it being subsequently reinvested upstream within the local economic area. The magnitude of the multiplier effect is thought to correlate positively with increases in the local well-being and social value outcomes associated with the initial spend.

Therefore, the local multiplier method returns an indicator reflecting the scale of the contribution an initial financial spend in a local network of relations has on the economic resilience and well-being of that geographic area. It does so by indicating the amount of additional purchases consequent to an initial investment for subsequent rounds of spend which, for each upstream supplier, equates to new money entering the system. However, beyond the fourth round of knock-on spending the ratio decreases rapidly (Sacks 2002).

One of the limitations of the LM3, as discussed in detail by Thatcher and Sharp (2008), is that the quality of third round data is unreliable. The return rate on surveys is generally quite low, and it is common to accept approximations by third

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1 See, for example, Sacks (2002) and Thatcher and Sharp's (2008) LM3 study of the Cornwall Food Programme for NHS procurement.

2 "Investment" as it is used in this paper refers to all of the income, including sales revenue and grant funding, of the case study SME.

3 Work is understood here as the use maximisation of an initial investment within a given community (Sacks, 2002). It implies a social network of participating economic actors.

4 "Spend" as it is used here is the purchase of goods or services as a customer.

round suppliers of their local spending. Two approaches to dealing with the third round data issues are discussed in a subsequent section..

This paper aims to contribute to the policy framework of regional sustainability from the perspective of locally sourced food as an economic driver. The paper is structured as follows. In the next section, we introduce the on-line retailer of local food as a case study business and provide a brief profile of the town of Market Harborough. Section three considers the LM3 in more detail and presents the findings from the empirical survey of upstream suppliers to the on-line retailer. The fourth section concludes the paper with a review of the findings and considers some of the policy and future research implications that arise from the study.

2. The case study: edibLE16 in the context of Market Harborough

To better understand both the decisions and motivations of consumers, as well as to offer a sense of the social and economic contexts of Market Harborough where the on-line retailer is based, this section briefly introduces edibLE16, the retailer, and then summarises key historical and demographic information to present a thumbnail sketch of the town as a community of persons who supply, support and purchase goods from edibLE16.

2.1. An on-line, click-and-collect retailer of locally sourced food and drink:

EdibLE16[5], was formed in 2013 as a partnership between the local chapter of the Transition Town group and a five year BIG Lottery funded Communities Living Sustainably[6] project, Sustainable Harborough. Since that time, it has become an independent registered business offering some 250 products on their website sourced from within a twenty mile radius of Market Harborough.

The nature of the company's offer ranges from locally grown produce and reared livestock products, to products that have been processed within the twenty

[5] The capitalisation of LE16 in edibLE16's name is a pun on the local post code which uses the LE16 prefix for this area of for Leicestershire.

[6] https://www.biglotteryfund.org.uk/global-content/programmes/england/communities-living-sustainably Accessed February 26, 2018.

mile geographic radius of the town (e.g., roasted coffee, chocolates, etc.), through to ready meals which have been produced using predominantly locally sourced ingredients.

EdibLE16 is a small business with annual sales revenue averaging £24,000 for the period considered here. One and occasionally two staff members have been employed over this time in the general capacity of manager, although this has covered a wide remit of responsibilities in practice. As will be shown below, the profit margin is low and the business relied heavily on the additional annual support of approximately £9,000 from the Sustainable Harborough Project.

As an on-line retailer, edibLE16 reduces the need for places to physically interact with customers; it does so through scheduled order collections as well as deliveries at the end of the week and engaging in periodic and seasonal activities at public events and farmers' markets. The space for collecting orders has been donated by a local pub for edibLE16 to use on a weekly basis.

That Market Harborough was a purpose-built market town is a useful context within which to locate edibLE16 as a business, as well as to interpret the values and motivations of its customers. The following section provides a brief summary of some of these key features.

2.2. The town of Market Harborough:

The history of Market Harborough suggests that it emerged rapidly between the Domesday Book of 1066, in which it was not listed, and a mention in the Pipe Roll in the latter part of the twelfth Century. That it was deliberately founded as a market town seems supported by its convenient location at one day's travel between two important medieval cities of Leicester and Northampton, providing both market and hospitality opportunities for visitors. By the end of the 17th century, Harborough had begun to specialise in agriculture, especially in dairy and stock farming, while attracting wealth from non-agricultural sectors (Gräf 1994; Hoskins 1957).

The town is located within the Welland Valley bordering the Laughton Hills and High Leicestershire to the north. It is a flat, shallow but wide river valley lined with arable pastures along its sides and with little in the way of tree cover.[7] The total area for the town is 1,978 hectares with an average density of 12.1 persons per hectare. In 2011, Market Harborough had a population[8] of 23,995, and the population of mid-to-late 40 year olds comprised about 6.73% of the population, with a second peak in the late sixties age bracket.

Overall, Market Harborough[9] suggests a relatively affluent, healthy, home owning population, with an extended commercial history of trade, food, hospitality, and innovation. The socio-economic demographic of Market Harborough cannot be excluded from a consideration of the relative successes enjoyed by an enterprise such as edibLE16.

We now turn to discuss in detail the economic multiplier effect of edibLE16 within the local area.

3. The LM3 economic impact multiplier evaluation method

The LM3 is a survey approach which evaluates the knock-on effect of an enterprise. The multiplier is the number of times an initial investment is spent within a given economic area before it leaves or "leaks" (Walsh 1986), and therefore is an evaluation of the total value of an investment to a local economic area. More formally, an economic multiplier "is the ratio of the total economic impacts in a region resulting from the sales of a particular sector relative to that sector's direct sales" (O'Hara & Pirog 2013: 38).

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7 As a characteristic of the geology, this likely accounts for the common knowledge that the area is only good for growing grass. That the place on which Harborough is now sited was itself once referred to as the hill on which oats grew supports this traditional knowledge and constrains the range of local foods that can be grown here.

8 ONS LSOA mid-2014 SAPE17DT1 data set, for the following LSOareas: Market Harborough North; Centre; East & Welland Industrial Estate; Coventry Road; North West; Lubenham Hill; South; Farndon; Welland Park; and Leisure Centre; Great Bowden; and Little Bowden South, East and West.

9 An updated summary of Market Harborough's socio-economic profile compared to the region and the national average is maintained at https://www.ilivehere.co.uk/statistics-market-harborough-leicestershire-24836.html (Accessed, January 6th, 2019).

The simplified version of the multiplier evaluation tool, the LM3, surveys the multiplier effect to the third round of spending (Sacks 2002), and although calculating multiplier effects is a complex process, the benefits of the method for evaluating local community benefits arising from inward investment has been recognised and supported by the UK-based New Economics Foundation (NEF). The evaluation returns a ratio of the initial unit of investment, £1.00, to the amount that remains in the community which is a figure between 1 and 3. A ratio of 3 means that 100% of the initial investment has remained in the community, while a score of 1 means that 100% has leaked out of the local economy, and remained out.[10]

By evaluating the LM3 ratio for a small and medium-sized enterprise (SME), such as edibLE16, a ratio can be returned indicating a quantification of the additional work customer spend with edibLE16 generates through the local supply chain. This indicator may also be used for performance monitoring and improvement planning to demonstrate the additional value of the business to the local area and upstream suppliers to investors. Where sufficient data are collected, the indicators could also potentially reflect comparisons among business models and across sectors within a given economic region (Sacks, 2002).

Because it is clearly impossible to track precise purchases, or to trace the actual money used,[11] certain simplifying assumptions are made. First, it is constrained to a defined geographical boundary which is relatively arbitrary and could be drawn according to any set of criteria, for example, along county boundaries or the reach of a case study business, as is the case here. Second, as the rounds of spending to be evaluated increase, the rigour of the data returned decreases. The LM3 method is a simplification of the more complex econometric input-output analyses, and consequently the degree of rigour and quality of data employed in calculating the LM3 is not equivalent to that calculated at a national scale, and

[10] A reviewer drew our attention to this distinction. Methodological updates to the on-line LM3 tool (See https://www.lm3online.com Accessed January 5th, 2019) now include previously leaked and returned spending in calculating the value of the ratio.

[11] In Justin Sacks' *The money trail* (Sacks, 2002), the metaphor of a blue painted pound coin is used to model how that pound might move through a village retail and service sector, leaving a blue imprint on all merchants who touch it. The number of merchants with a blue finger print is the measure of the multiplier effect: the more blue fingers, the higher the multiplier effect of that initial £1 coin.

therefore *the LM3 results are to be treated as indicative only*. That is, the LM3 ratio (of initial spend to third spending round) indicates a pattern of approximated or estimated influence; it is not a precise metric (Sacks 2002; Thatcher & Sharp 2008).

3.1. Applying the LM3 method

Because the LM3 uses a survey approach to data collection, in addition to the first round (R1) which reviews the focal organisation's (edibLE16) financial data, upstream suppliers to the focal organisation are also contacted to request information. This was undertaken in two successive rounds. Round 2 (R2) surveys data from the suppliers to edibLE16 and round 3 (R3) surveys those businesses which supply the R2 suppliers. This is the meaning of the LM3 as evaluating the local multiplier effect to the third round.

In practice, upstream (R2) supply chain actors were approached to obtain the estimated percentage of local spend by suppliers to edibLE16. This led to almost 30 of the more significant suppliers being contacted via email and by telephone, and in some cases, a follow up email was sent, and up to two follow up telephone calls were made. Given the small number of staff employed by edibLE16, to limit risk of reducing respondent anonymity, we purposely excluded surveying individual staff on their own R3 spending patterns.

Of the 55 unique local suppliers to edibLE16 over the period of the study, 21 questionnaires were returned from a range of food and drink sectors.[12] This survey response reflected a reasonable cross-section of the supply-base, with the exception of those who supplied baked goods, for which no information was returned. The suppliers who responded to the survey attract 50% of the R2 spend. When the total of wages paid is removed, the total R2 spend is reduced to £54,615, which means that the amount of spend with those suppliers who responded to the surveys rises to 70% of the (amended) R2 income stream to the area.

[12] Over the period of the three years covered in this study, the number of suppliers fluctuated from 35 in 2014 – 2015, 40 in 2015 – 2016, to 36 in 2016 – 2017. These fluctuations are reflected in Table 8 as the sum of the two columns labelled "Suppliers Reporting % local spend (R2)" and "Suppliers Not Reporting (sector median attributed in R3)".

However, the method of the LM3 does not permit excluding contributions to the R2 spend on a selective basis into, for example, grant funding and sales revenue if these streams are combined in future spending. From the perspective of the model, the R2 is – and must necessarily be, for the model to work – *the sum total of all spend* by edibLE16 which meets the criterion of being spent with suppliers within the defined area. What happens to that income stream is then the focus of the R3 calculations.

In the light of there being some missing values due to a lack of response from surveyed suppliers, in one instance representing the entire baked goods supply sector, a diverse range of one-off payments, and the methodological decision to exclude surveying staff employed by edibLE16, there are a number of missing values which have to be addressed in the R3 calculations. Two approaches have been taken.

The first approach uses only those percentage estimates returned by surveyed suppliers. That is, the 21 responses were used to calculate the ratio of R1 income with third round local spend, because the percentage of R2 income to these suppliers was known with a reasonable degree of confidence.[13] Using this method, those suppliers which did not respond, or were not surveyed, were excluded in terms of their contributions to the R3 local spend because this was unknown. In the calculations that follow, this approach is referenced as R3(a), which leads to the derived ratio LM3(a).

The second approach to the missing values sought to find a way to include, in a logically defensible way, as many of the missing values as possible, without violating the method of the LM3 model. This approach, referred to as R3(b), clusters the suppliers into food and drink supply clusters on the basis of the principle focus of the business. This generated nine clusters, referred to here as ‘sectors’, including the catch-all cluster of wages paid, one-off payments, admission and venues rental

[13] This confidence rests on the untested assumption that the suppliers each interpreted the request for information by applying the estimate in the same way. The degree to which this was actually the case is not known. However, it does lead to some recommendations for any future iterations of the LM3 method.

costs, and so on. Of these nine sectors, there was at least one representative business for each of the nine sectors, bar two. One of these was the diverse ‘Other’ cluster of services (designated as ‘OT’ in the spreadsheet calculations), and the other was ‘Baked Goods’ (or ‘BG’) cluster.

For the remaining seven sectors about which at least one business had responded to the survey, the median percentage estimate for that sector was determined, and then applied to other suppliers representing that sector which had not responded. For example, if three businesses from the fruit and vegetable sector (‘FV’) had responded with estimates, their estimates were combined and the median value used as the basis with which to evaluate the percentage of local spend by other FV suppliers about which no information was available.

In effect, this approach extrapolates from the known median values of a sector to fill in the missing values of other suppliers within that same sector. Of course, where the values were known, these were retained throughout. Only the missing values were supplemented by median values from the same sector. This second approach derives the LM3(b) ratio.

A twenty mile radius affords a business like edibLE16 ‘local’ access to large urban, peri-urban, and agricultural areas from Leicester to Rugby and into Northamptonshire. One would expect a reasonable LM3 as a result given the range of enterprises which likely fall within this boundary. However, a significant amount of edibLE16’s spend with suppliers falls within an area much smaller than the selected boundary.

To be clear, the LM3 is an indicator, not a precise metric. It is an indicator of the *pattern of economic efficiency* in a local economic area given an initial impetus (R1) of investment or spend. In some bounded areas, there may be a desert of economic activity: no local businesses, not even any corner stores. In other areas, there may be an oasis, with almost everything one could want within a set radius.

The issue concerns the nature of the boundary defined, and the context of the socio-economic spaces within which that boundary is defined.

The calculation of the LM3 for edibLE16 involves three sequential calculations, as follows:

Calculate R1, by initial investment amount per financial year

Calculate R2, by the amount of R1 spend per financial year within the area

Calculate R3, by the percentage of R2 spent locally per financial year

These steps are discussed below:

3.2. Round 1 (R1) calculations

The records for edibLE16 begin in mid-October 2014, and are grouped by fiscal year:[14]

2014 – 2015: October 13 2014 to August 27th 2015[15]
2015 – 2016: September 1st 2015 to August 31st 2016
2016 – 2017: September 1st 2016 to August 30th, 2017

Within these records, there are also two types of income, grant funding and customer sales. For completeness, these are summarised (in £s) as follows (Table 1):

Table 1. R1 Spend summary (rounded values)

Year	Grant Funding	Customer Income	Total R1:
2014 – 2015	6,3910	15,249	21,640
2015 – 2016	15,199	28,166	43,364
2016 – 2017	4,755	29,254	34,008

[14] The financial year for edibLE16, according to Companies House records, is September 1st to August 31st.

[15] This is the start up period which, although shorter, does not affect results as the indicator is a ratio of income and spend.

Year	Grant Funding	Customer Income	Total R1:
Total:	**26,344**	**72,668**	**99,012**
Ave:	*8,782*	*24,223*	*33,004*

The income streams have *not* been distinguished in the following calculations because no provenance can be attributed to either in upstream spending, and to remove one stream introduces systematic error.

3.3. Round 2 (R2) calculations

Differentiating the suppliers paid by edibLE16 from the R1 income into local and non-local, results in the following summary (Table 2.). Table 2 summarises the expenditure for each financial year across suppliers that can be differentiated into local, non-local, and those where the location is unknown.

Table 2. R2 Spend summary (rounded values)

Year	Total (R2):[16]	R2 Local	% R2 Local Spend	Non-Local	Unknown
2014 – 2015	20,263	17,258	85.17	1,760	1,246
2015 – 2016	37,857	33,074	87.37	1,800	2,983
2016 – 2017	29,487	26,320	89.26	1,803	1,364
Total:	**87,607**	**76,652**	**–**	**5,363**	**5,593**
Ave:	*29,202*	*25,551*	*87.26*	*1,788*	*1,864*

Table 2 summarises the amount of spend by edibLE16 with supply chain actors. Of this, the proportion and percentage of total spend within the twenty mile radius of Market Harborough is shown. It is apparent from Table 2 that edibLE16 have, since the beginning of their business, made an effort to invest with local suppliers, with an overall average spend as 87% of total income with local suppliers. There is the potential that this could be higher, but a number of suppliers were not identified in the source data and could not be included in the evaluation.

[16] Total (R2) refers to all spend by edibLE16. This is further broken down into local, non-local and unknown spend where the creditor can be identified. For the purposes of the LM3 method, only the local component of the R2 is used.

Spending with non-local sources is commonly associated with services, such as banks, insurance premiums, SagePay and Microsoft Office systems, and also with nation-wide advertising opportunities. Generally, spend with national chain stores and services was excluded from the evaluation as these are not locally based. For the next round (R3) of calculations, the data pertaining to the “R2 Local” column of Table 2 are of interest.

3.4. Round 3 (R3) calculations

As outlined in the Introduction, two methods of evaluation are applied to the R3 data set. The first excludes all of those suppliers to edibLE16 which did not respond to the surveys, along with the percentage of local spending by people employed by edibLE16 who were not surveyed for ethical reasons. This leaves a basis of 21 suppliers which did respond with estimated percentages which are taken account of in the first approach to evaluate the R3, and which is referenced as the R3(a) and LM3(a) evaluations.

The second approach to working with the unreliability of third round data has already been discussed as the R3(b) and LM3(b) streams. Each is considered in turn.

3.4.1. LM3 ratio using reported percentages: LM3(a)

For this evaluation stream – R3(a) and LM3(a) – only those suppliers which reported an estimated percentage of income spent locally (within the twenty mile boundary) are included in the calculations. While it reduces the relative proportion of R3 spending, this method uses data about which there is a higher degree of confidence in its accuracy.

Table 3 summarises the R3 spend with the 21 suppliers which estimated the percentage of income spent locally within the designated radius. The values in the R2 Local spend column are the cumulative spend by edibLE16 with those suppliers

which reported on their estimated percentage of local spend, as per the ‘R2 Local’ column in Table 2.

Table 3. R2 income for suppliers with known percentage of local spend (rounded values)

	R2 Local spend	Spend with suppliers reporting R3	% of local R2
2014 – 2015	17,258	10,132	58.7
2015 – 2016	33,074	15,648	47.3
2016 – 2017	26,320	12,629	47.9
Total	**76,652**	**38,409**	**50.1**

As Table 3 shows, constraining the evaluation to only those suppliers which responded to surveys about estimated local spend of income, spend with these suppliers comprises 50% of the R2.

Table 4 applies the values from Table 3 to summarise the amount spent locally by these suppliers. This comprises the R3(a) spend values.

Table 4. R3 Spend summary (rounded values)

Year	R2 Income	R3(a) Spend	% Local R3(a)
2014 – 2015	10,132	6,475	63.9
2015 – 2016	15,648	8,140	52.0
2016 – 2017	12,629	6,887	54.5
Total	**38,409**	**21,502**	**56.1**

To derive the first LM3(a) ratio, only these figures will be used. The formula for deriving the LM3 is as follows, using a worked example from the three rounds of 2014 – 2015 spend.

LM3(a) for 2014 – 2015:

$$= \frac{R1 + R2 + R3(a)}{R1} \quad (1)$$

$$= \frac{R1 \text{ (Table 1}^{17}\text{)} + R2 \text{ (Table 3}^{18}\text{)} + R3(a) \text{ (Table 4}^{19}\text{)}}{R1 \text{ (from Table 1)}}$$

$$= \frac{21{,}64 + 17{,}258 + 6{,}475}{21{,}640}$$

$$= \mathbf{2.10}$$

To calculate the *additional* income generated for the economic area within a twenty mile radius of Market Harborough for every £1.00 invested, the formula is:

$$= LM3 - 1$$

$$= 2.10 - 1 = \mathbf{1.10}$$

Therefore, for every £1.00 spent with edibLE16 in 2014, an additional £1.10 is generated for the economic area by those suppliers which reported on their own local spend. Using these variables, and the corresponding values from Tables 1, 3 and 4, Table 5 summarises the LM3(a) for each of the three financial years, and provides an overall, cumulative, LM3(a) ratio.

Table 5. LM3(a) values for known R3(a) spend (rounded values)

Year	R1	R2	R3(a)	LM3(a)
2014 – 2015	21,640	17,258	6,475	2.10
2015 – 2016	43,3644	33,074	8,140	1.95
2016 – 2017	34,008	26,320	6,887	1.98
Total	**99,012**	**76,652**	**21,502**	**(Ave): 2.01**

[17] In Table 1, this is column 'Total R1'
[18] In Table 3, this is column 'R2 Local spend'
[19] In Table 4, this is column 'R3(a) spend'

The average LM3 ratio is 2.01, meaning that over the three year period, for every £1.00 invested with edibLE16, an additional £1.01 was generated for the local economic area. There is, from a return on investment perspective, a 1:1 ratio, a macro-economic version of match funding for every £1.00 spent with edibLE16.

3.4.2. LM3 ratio using sector-based assumptions: LM3(b)

The first approach excluded the missing survey responses from the evaluation. The second approach develops a method with which these missing values can be incorporated into the evaluation, using median values[20] as proxies for the missing values of spend in that sector.

This second approach can be illustrated through an example: in the 2016 – 2017 financial year, there were seven upstream suppliers which comprise the fruit and vegetable sector (designated as 'FV'). Of these, four reported their estimated local spend, while three did not. By deriving the median reported spend, a sector median can be determined, which can then be applied to those suppliers which did *not* respond to surveys. In this example, the median value in 2016 – 2017 was calculated at 87.5% of income to that sector being spent locally. Therefore, for the three businesses which did not report their estimated local spend, 87.5% is used as a normalising assumption with which to calculate a reasonable percentage of spending locally for that sector.

The values reported by businesses will be used, and the median value will only be applied to those businesses which did not respond. By using this approach, the influence of missing values can be reduced albeit at the cost of confidence in the accuracy of the values derived.

Table 6 summarises the different sectors and the median percentages derived for each supplier for the 2016 to 2017 financial year.

[20] The median is the point at which there are an equal number of data points whose values lie above and below the median value. It is a preferable statistics to average (or means) which are distorted by outlying values.

Table 6. Sector-based summary with median % local spend

Sector	n Suppliers reporting	Median % local spend
Alcohol	2	17.5%
Baked Goods	0	0
Dairy & Eggs	3	40%
Fruit & Vegetables	4	87.5%
ICT, Marketing & Media	1	40%
Meat & Fish	1	80%
Other (e.g. wages)	0	0
Prepared & Dry Goods	5	70%
Speciality Goods (e.g. confectionery)	2	11%

To deal with the missing values for businesses which did not respond to the surveys then, these median values will be used instead in order to not lose out the contribution from these businesses. Unfortunately, as no representative of the baked goods sector responded, this method continues to exclude the contributions of this sector to the R3 spend. This means that up to five businesses which attracted a combined R2 spend over the three years of £3,274 have to be excluded from the calculations. It is difficult to calculate the influence this may have exerted on the R3 ratio.

In Table 7, the R3(b) calculations are summarised, to generate the LM3(b) ratio. R1 and R2 remain constant.

Table 7. LM3(b) values using combined known and derived median values (rounded values)

	R1	R2	R3(b)	LM3(b)
2014 – 2015	21,640	17,258	9,489	2.24
2015 – 2016	43,364	33,074	12,247	2.05
2016 – 2017	34,008	26,320	8,130	2.01
Total	**99,012**	**76,652**	**29,866**	**(Ave): 2.10**

Table 8, below, summarises all of the LM3 calculations, including the two methods taken to address missing values.

Table 8. Summary of all LM3 calculations (rounded values)

	R1	R2	R3(a)	R3(b)	LM3(a)	LM3(b)	Added £ (a)	Added £ (b)	Suppliers Reporting % local spend (R2)	Suppliers Not Reporting (sector median attributed in R3)	Suppliers Excluded from R3 spend (Unknown contribution)
2014 – 2015	21,639.60	17,258.10	6,475.31	9,488.53	2.10	2.24	1.10	1.24	17	18	8
2015 – 2016	43,364.23	33,073.86	8,139.59	12,246.76	1.95	2.05	0.95	1.05	21	19	8
2016 – 2017	34,008.43	26,319.69	6,886.68	8,130.24	1.98	2.01	0.98	1.01	18	18	6
Total:	99,012.26	76,651.65	21,501.58	29,865.53	NA	NA	NA	NA			
Average:	33,004.09	25,550.55	7,167.19	9,955.18	2.01	2.10	1.01	1.10			

Notes:

R1 = Initial spend with edibLE16
R2 = edibLE16 spend with local suppliers within 20 miles of Market Harborough
R3 (a) = Upstream suppliers reporting percentage of income spent within twenty miles of Market Harborough
R3 (b) = Upstream suppliers to edibLE16 with known and attributed median percentage spend by sector
LM3 (a & b) = Ratio of initial income to upstream local spend (higher means more money remains in local economic area)
Added £ (a & b) = Additional money to the economic area as a result of spending with edibLE16

NB:

R1 is ALL income to edibLE16
R2 is ALL local spend regardless of whether or not the R3 spend is known
R3 has been calculated for known local spend (traditional method) [R3(a)] and has derived values for missing values in sectors where median percentage can be calculated

3.5. Reflections on using the LM3 method

The findings from this evaluation are considered from two perspectives. The first concerns the management of data, including missing values; and the second reflects on the nature of the supply chain and the influence of this on the LM3 ratio.

3.5.1. Data management

Like all research, the LM3 evaluation is only as useful as the quality of the data it works with. In the instance of the LM3 evaluation, two approaches were taken to deal with missing values from non-responses to the R3 surveys with upstream suppliers.

The first of these (the 'a' stream) derived the LM3 ratio solely by using the data returned in the surveys. Across the three years, data for the R3 spend could be derived in this way with reference to the suppliers who reported their own spend. As has been shown (see Table 5), over the three years, the known R3(a) spend equates to 28% of the R2 spend. Put differently, over the three years, less than half the number of suppliers (~43%) generated an average of an additional £1.01 for every £1.00 spent with edibLE16. This is a significant contribution, considering that the survey response rate constrained the data that could be included in the calculations.

The rationale of the LM3 method is to track the efficiency of initial investments through a defined geographic area. By doing so, the multiplier effect of the initial (R1) investment through the system is demonstrated. In the case of initial spending with edibLE16, whether through grant funding or customer sales, and whether the evaluation uses only known values or a combination of known and derived proxy values, the result is a positive contribution to the local economic area to the value of an additional £1.01 for every initial £1 invested, which, when factoring in missing values, increases to £1.10 for every £1.00.

In terms of interpreting the LM3 ratio itself, especially with respect to seeking strategies to optimise this, it is useful to bear in mind that the minimum value of the

ratio is 1.00 and the maximum is 3.00. The average for both approaches used here is 2.01 and 2.10 respectively, so while it is indeed possible to increase the value of the ratio, it should also be recognised that it is already quite robust.

Having said this, one also needs to identify whether the ratio generated is constrained due to sampling effects or is constrained by the extent of local (R3) spending. In the present evaluation, the distinction between the R3(a) and R3(b) values is reflected in a corresponding increase in the LM3(a) and the LM3(b). One would expect this: a greater proportion of the R2 spending is, in turn, being spent locally, and in turn this increases the value of the ratio.

Therefore, to improve the value of the LM3 ratio, it is recommended that the sampling strategy is reviewed so that the response rate among suppliers is increased. More responses lead to a more accurate analysis of how much of the R2 income stream is being spent locally. An entire sector, the baked goods suppliers, was excluded because no representative value could be attributed to account for the missing values. Moreover, as noted, this evaluation decided against surveying edibLE16 staff due to risks of reducing respondent anonymity. However, in future evaluations, an alternate decision might be taken, especially considering the amount of R2 spend that was attracted by wages. To improve the value of the ratio then, the first step would be to review the surveying method and the number of responses received.

Unfortunately, evaluations rarely deal with perfect data sets, and inevitably some data will continue to be missing. One potential approach to increasing response rates is to ask suppliers at the point where they are signing up to edibLE16 detailed questions about their estimated percentage of spend within the local area. Because businesses are already providing details, and have a vested interest in becoming part of the edibLE16 supply chain, this is likely to be an opportune time to gather the data. These can be periodically confirmed, but are likely to remain relatively consistent over time.

3.5.2. The supply chain

The economic area of interest is a twenty mile radius of Market Harborough. This extends to Rugby in the south west, Leicester city to the west, along with a significant portion of north western Northamptonshire. The decision about the radius was predicated on the range within which edibLE16 deliver orders to customers, and is therefore the source area for R1 spending.

From evaluations of the R3 spend, that is, the percentage of local spend by edibLE16's own suppliers, the fruit and vegetable sector reported the highest median percentage of local spend consistently across the three years. In 2014 to 2015, the fruit and veg R3 median value was 82.5%, in 2015 to 2016, this went up to 90%, and in 2016 to 2017, it dropped to 87.5%.

This can be usefully contrasted with the lowest median percentage for local spend, the speciality goods sector. Across the same three year period, the median percentage of local spend was 7%, which then for the next two years rose to 11%. The only comparable sector was that producing and selling alcoholic beverages, which across the same period began at 17.5%, rose to 20% in the 2015 to 2016 year, and dropped again to 17.5%. These are summarised in Table 9 across the three sectors representing the range of R2 spend.

Table 9. Highest and lowest R3 median percentages by sector

Year	Median Alcohol Sector	Median Speciality Goods Sector	Median Fruit & Vegetable Sector
2014 – 2015	17.5%	7%	82.5%
2015 – 2016	20%	11%	90%
2016 – 2017	17.5%	11%	87.5%

The nature of the sector itself appears to be the primary influence on the range of median R3 percentages summarised in Table 9. While fruit and vegetables draw on very few additional components, and are sold onto edibLE16 without any further processing, items such as alcohol and speciality goods, such as

confectionery, are more heavily processed. As a result, the percentage of local spending for fruit and vegetable suppliers is considerably higher, in some cases reported as 100% because the stock was grown in the gardens of small-scale suppliers. The draw from outside of the twenty mile radius is therefore significantly less than for those producers and suppliers of alcohol and speciality goods, which must buy ingredients from outside of the local area.

There is very little that can be done about this from edibLE16's perspective if they want to continue to offer customers a wide range of goods. However, it is worthwhile keeping in mind that the LM3 ratio will be influenced by what can be sourced from within the designated area and what requires importing from outside of that boundary.

This may be counter-balanced by the amount of R2 income that is attracted by different sectors. From the available data, excluding the amount spent as wages, the R2 spend attracted by those suppliers which responded to surveys is 70% of all R2 spend (£34,408.87 of £54,614.65). When this is broken down by sector, the sectors which attracted the most R2 spend were the fruit and vegetable sector (19.95%), the prepared and dry goods sector (19.35%), and the ICT, media and marketing sector (15.8%). By comparison, the speciality goods sector attracted only 2.02%, while the 'other' sector (miscellaneous and once off payments) only attracted 0.82% of the R2 spend. It is evident therefore that the sector which attracted the most R2 spend is also the sector which reported the highest median percentage of local spend, while the sector that attracted the least R2 spend, also reported the lowest median percentage of local spend.

This pattern reflects a supply chain that is strongly biased towards keeping initial investment within the bounded twenty mile radius. Of the few published studies, Thatcher and Sharp (2008) calculated a LM2 ratio of £1.07 for the Cornwall Food Programme, and this seems in keeping with the ratios found here.

4. Discussion

Over the preceding pages the on-line retailer of locally sourced food and drink located in the south eastern town of Market Harborough has been considered from two distinct perspectives. The first and more substantive part of this paper reviewed the LM3 evaluation of the economic impacts of edibLE16 on the geographically bounded twenty mile radius of Market Harborough. As was demonstrated, depending on the method adopted to account for the missing data, the added value of an initial £1.00 investment with edibLE16 ranged from between £0.95 to £1.24. This may be conceptualised as 'new' money circulating in the local economic area.

While the LM3 model may be rightly criticised for its lack of precision it nevertheless offers a theoretically coherent and pragmatic tool for evaluating local economic multipliers. Our experience in conducting the LM3 survey was that evaluations to the second round – effectively an LM2 model – are both administratively easier and potentially more accurate due to the degree of atrophy in third round supplier response rates, a conclusion shared by others who have also used this method (e.g., Thatcher & Sharp 2008). However, even with these limits, future research into the potential economic benefits of a local food network can be undertaken. The results from doing so offer a contribution to developing more sustainable regional food policies and lays out the ground work for analysing gaps, bottlenecks and opportunities for development within existing local food and drink supply chain networks (Teigeiro & Díaz 2014).

For example, given the review of the edibLE16 supply chain as summarised in Table 9 above, the sector offering the largest proportion of the overall multiplier effect is the fruit and vegetable sector, followed by the alcohol producers. Speciality goods make a comparatively smaller contribution overall and this suggests that, in an effort to further increase the multiplier effect in the Market Harborough area, edibLE16 might seek to extend the range of R2 and R3 suppliers of speciality goods who are not only themselves based locally, but which also are supplied by locally-based upstream suppliers.

However, as the profile of the town suggests, Market Harborough is a reasonably affluent town, and has an extended tradition of local markets, agriculture and hospitality, and it is conceivable that this tradition and purchasing power may mitigate some of the common constraints to take up, such as pricing and affordability, previous local food researchers have found (e.g., Edwards-Jones et al. 2008). Arguably, given the historical and socio-economic context of Market Harborough, the local food sector may even lend itself to a successful "ecological entrepreneurship" achieved via networked forms of value-capture, such as "agri-tourism, engagement in off-farm incomes activities and environmental schemes and projects", including local food production and branding (Marsden & Smith 2005: 441).

On the basis that sustainable economies are envisaged as resilient to shocks, such as the 2008 sub-prime mortgage financial crisis and the UK governmental policy of austerity for example, a model for a resilient economy may be construed as incorporating an optimal degree of redundancy in the supply chain with several actors in each sector ensuring continuity of supply. It is here that the District Council has a potential role to play in contributing to regional resilience by introducing financial and other incentives to locally-based businesses to preferentially select other locally-based supply chain partners.[21]

By increasing network density, the overall resilience and social capital of the local economic network is consolidated (Glowacki-Dudka et al. 2013), which in turn, makes it more sustainable over time, while contributing to a balancing of the triple bottom line with respect to regional social, environmental, and economic sustainability (Elkington 1998).

5. Conclusions

In this paper, we have considered the contributions of a small on-line retailer of locally sourced food and drink from an economic impact perspective. While local food networks and supply chains can often be complex to map out, the economic

[21] Assuming, as one reviewer observed, that such an approach be subject to "robust ex ante" audits.

multiplier survey method used here contributed significantly to simplifying this endeavour.

What we found, and elaborated on here, is that the multiplier effect ranged from between £0.95 and £1.24 of additional income to the area via the third round of upstream supply chain audits. This suggests that the local food and drink supply chain that edibLE16 has tapped into to provide its stock is quite close knit and seems to emphasise the value of locally sourcing supplies and services.

With an increasing policy emphasis on social, economic, and environmental sustainability in food supply chains, this paper offers a systematic account of a case study business that seems to be demonstrating these objectives. Arguably, there remains scope for improvements, but from a review of the three years of available data since the conception of edibLE16 it is apparent that the business is making a contribution to the resilience of the local economic area.

Opportunities for further research may be considered in testing the density and hence resilience of the local food and drink supply chain, both in terms of the network which edibLE16 itself converges, but also more broadly. The social network analysis of supply chain actors is likely to help identify potential gaps and vulnerabilities, as well as opportunities for optimising the inter-connectedness of the actors. In turn, this work would have tremendous benefit for the generation of a local or regional sustainable economic development policy framework. We hope that the present paper is a contribution to that process.

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